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Urbanization and Child Malnutrition: A Comparison of Three Countries in the Greater Mekong Sub-region

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Abstract

Success in reducing monetary poverty in Southeast Asia has not fully translated into reduction in malnutrition. Using a two-year panel data from one province each in Thailand, Lao PDR and Vietnam, we study the correlation between monetary poverty and nutritional outcomes of children under five. Furthermore, we compare nutritional outcomes of children below five between rural and peri-urban areas. We apply ordinary least squares and district fixed-effects regressions and find that child nutrition remains a problem in rural areas across Southeast Asia despite achievements in poverty alleviation. Results reveal that although the households in the poorest quintile in both rural and peri-urban areas spend less on food; only the rural children are more likely to be stunted or underweight. It underscores the importance of investment in medical facilities near rural vicinities.

Keywords: Poverty, Child malnutrition, Peri-urban, Rural, Fixed-effects, Southeast Asia

JEL: O1, O18, I3

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1. Introduction

Thailand, Lao PDR and Vietnam are countries that belong to the Greater Mekong Sub-region. All have developed rapidly but at different starting points and with different rates of growth. Thailand has now reached the level of an upper-middle income economy. Vietnam has followed the growth path of Thailand after the impact of the *Doi Moi* policy reforms. Since about 2000 Vietnam had annual rates of economic growth in excess of 7 % and has now reached the level of a lower-middle income country. Lao PDR has only recently opened its economy to private initiatives and foreign direct investments. As a result it is now achieving similar growth rates as the two neighboring countries but until now it is still one of the poorest countries in Asia (WB, 2017). However, monetary poverty has declined rapidly in the past decade in all the three countries albeit to different levels. The question that is of interest in this regards is to what extent reduction in monetary poverty has translated in the reduction of other types of poverty such as nutrition. Nutrition is of particular importance for the long term development success since malnutrition can negatively affect the outcomes of health and education. As shown by many literatures (Anand and Sen, 1997; Ferreira, 2011; Alkire and Foster, 2011; Bourguignon and Chakravarty, 2003) poverty is multi-dimensional and the correlation between reducing monetary poverty and non-monetary poverty measures is often low. A weak correlation between monetary poverty and nutritional poverty has been found in several empirical researches (e.g. Baulch and Masset, 2003; Haddad et al. 2003, Alderman et al. 2006).

It is well established that nutritional status during early stages of childhood has an impact on the physical, mental and social development of the child later on (UNICEF, 2016). Evidences show that the nutritional status of children in developing countries can vary considerably; especially

between urban and rural areas. The children in urban areas generally have a better nutritional status than their rural counterparts thanks to favourable socioeconomic conditions (Frankenberg et al., 1998; Garrett and Ruel, 1999; Smith et al., 2005; Fotso, 2007). However, there is a lack of understanding of the causes of differences in nutritional transitions and nutrition outcomes between rural and urban areas in the process of economic development. As countries grow formerly rural areas are urbanizing which leads to the emergence of so-called peri-urban areas.

Hence, this study aims to fill this gap in literature and examines nutritional transitions in rural and urbanizing areas of Thailand, Vietnam and Lao PDR. Our motivation is to generate a better understanding of the nutrition transitions as these countries urbanize in the process of development. We use panel data from rural household survey carried out between 2011, 2012 and 2013 and apply a standard nutrition outcome model.

We have two major findings. First, in the course of development, households both, in urbanizing and in rural areas are spending less on food but the likelihood of stunting and underweight is significantly higher in the rural areas. Second, although poverty has declined to low levels in the three countries; malnutrition remains a problem even in Thailand, the most developed among the three countries in our study.

The paper proceeds as follows. The next section outlines the methodology and the details of the study areas and the data collection procedure are discussed in section 3. . Section 4 reports and discusses the results and section 5 concludes with some policy recommendations.

2. Methodology

Nutritional outcomes of children are widely assessed by age and gender standardized anthropometric indicators. The most common anthropometric indices for accessing the nutritional status of children are height-for-age (HFA) and weight-for-age (WFA). These indices are interpreted according to the World Health Organization (de Onis & Blössner, 1997). Low height-for-age is indicator of stunting or shortness reflecting slowing in skeletal growth over a long period of time. A low height-for-age is usually caused by accumulated poor socioeconomic conditions or long-term nutritional deprivation. A low weight-for-age implies an existence of underweight and is generally associated with short-term dietary deficiencies. These indicators are commonly interpreted based on the Z-score classification system as defined by the World Health organization (WHO, 2016)[4].

We use the UNICEF (Ruel, 2008; UNICEF, 2013) framework to examine the drivers of malnutrition. The nutritional outcomes of children are determined by a set of immediate, underlying, and basic causes relating to biological, behavioral, and social aspects. Accordingly, child nutrition depends first and foremost on the food and nutrients that a child takes as well as the child's health condition. These two determinants are placed as the immediate causes of child malnutrition. The framework also highlights the importance of the household's access to food, childcare practices, and water and sanitation services as underlying causes. Moreover, institutions, economic and political context together with environment constitute the basic component of childhood nutrition.

[4] The Z-scores define anthropometric value as a number of standard deviations (SDs) below or above the reference mean or median value of the WHO reference population. The prevalence of undernutrition is determined by the cut-off of < -2SD.

Following Becker (1965) and Strauss and Thomas (1995), we use household theory to establish causality between socio-economic conditions and malnutrition as household nutrition is also a component of its utility function, given its resource constraints and production choices. Thereby, we apply a reduced form nutritional function derived from the household production function to determine the nutritional outcomes of children under five (Glewwe et al., 2004; Alderman et al., 2005; Kabubo-Mariara et al., 2006; Waibel and Hohfeld, 2016) as below:

$$N_{it} = f(E_{jt}, C_{it}, M_{it,} H_{jt,}, V_{kt}, \varepsilon_{it}) \quad (1)$$

where *t* stands for the time *(t=2011, 2013, 2014)*, *i, j* respectively symbolize child *(i=1, 2,..,1345) and* household *(j=1,2,…, 1105). N* denotes the nutritional outcomes WFA and HFA Z-scores of the child indicating short-term and long-term nutritional status. *E* is the household's aggregate consumption per capita that includes expenditures of households on food, non-food, and housing related consumption in the preceding year. We use consumption rather than income as the indicator of household wealth since consumption data are likely to be more accurate than income data in developing countries (Deaton, 1997; Glewwe et al., 2004). Moreover, consumption reflects long-term income stream and not just the income of the reference period (Haddad et al., 2003; Glewwe et al., 2004). *C* represents a vector of child characteristics such as age, health status and gender. *M* indicates a number of mother characteristics including age, nutritional outcomes, education and migration. *H* denotes household attributes like size, female headship, number of children under five, migration of other household members, access to tap water and sanitation ε is randomly distributed error term.

In order to see the effects of food consumption on child nutritional outcomes, we subsequently run regressions of the per capita food expenditure on the same set of explanatory variables as in the equation 1.

We begin the estimation with the ordinary least squares (OLS) method. Additionally, we also use the district fixed-effects to estimate these two Z-scores in order to control for the unobserved and omitted heterogeneities across districts such as local health environment or locally implemented public health intervention programs.

3. Data

We include three provinces in this study, namely Ubon Ratchathani in Thailand, Savannakhet in Lao PDR and Thua Thien Hue in Vietnam. These three provinces are geographically connected (ADB, 2010) and they are predominantly agricultural areas, albeit with quite different levels of development. Ubon Ratchathani is located in Northeast Thailand which formerly was the poverty pocket of Thailand. Recently the province has enjoyed rapid development with a well-developed road network and good accessibility to markets and public services. With a few exceptions, all districts in this province are urbanizing rapidly and therefore can be labelled as peri-urban. Savannakhet province is located to the northeast of Ubon and to its west shares the Mekong River as common with Thailand. Savannakhet is heterogeneous in terms of development and the degree of urbanization. The western part shows a similar degree of development as Ubon Ratchathani and therefore can be considered peri-urban. The central part of the province is still largely rural with poor roads and few infrastructures. It is similar with the eastern part which shares a common border with Vietnam, Finally, Thua Thien Hue province in

Vietnam has a rapidly developing and urbanizing coastal and lowland area and a completely rural mountainous region which is bordering Laos PDR to its west.

The data used in this analysis for Thailand and Vietnam are part of a research project called "Thailand-Vietnam Socioeconomic Panel" (see https://www.tvsep.de). For Laos the panel data were collected as part of a research project on Food Security in Savannakhet (Laos). The surveys were conducted in different time periods. For Ubon Ratchathani and Thua Thien Hue, it took place in 2011 and 2013 while in Savannakhet it was conducted in 2013 and 2014. The total number of households in the panel in the three provinces is around 2200. However, we only included households with children under the age of five. Hence our data base includes 1105 households with 1345 children under five from three provinces in three countries. We further group the sample population in urbanizing (peri-urban) and rural areas, i.e. we have three replications of peri-urban and two of rural areas in two years respectively in our study.

The sampling procedure differs for the three provinces due to the variation in the agro-ecological and institutional conditions (Hardeweg et al., 2013). A three-stage sampling method was applied in Thailand and in Vietnam while in Lao PDR a two-stage method was used (Parvathi and Nguyen, 2018). Furthermore, Ubon Ratchathani province (Thailand) was treated as a constituted stratum with a random selection of sub-districts as the primary sampling unit. In the first stage, sub-districts were selected with probability proportional to the population size. In the second stage, two villages were randomly chosen from each sampled sub-district. In the third stage, 10 households from each sampled village were selected systematically from a list of households ordered by household size with equal selection probability. This sampling method makes Ubon Ratchathani a self-weighted sample.

Thua Thien Hue province (Vietnam) is characterized by diverse topography. Hence three strata representing three agro-ecological areas, namely coastal, lowland, and upland were specified in the first stage. The sampling procedure in each stratum of this province was similar to that in Ubon Ratchathani.

In the absence of a well-defined administrative structure and reliable baseline data in Laos, villages were used as the primary sampling unit. In the first stage, villages within the strata region were sampled. The probability of a village being chosen was proportional to its size. In the second stage the cluster size of 15 households per village in the Mekong and lowland regions while 10 households per village in the mountainous region were applied. Households were then selected randomly from the village lists.

In the surveys, comprehensive questionnaires were used consisting of several modules such as household members, health status, housing and sanitary conditions, assets, consumption expenditures and income generating activities, especially from agriculture and natural resources. The data on nutrition outcomes for children under five include age, gender, height and weight as well as health conditions during the reporting period and information on infrastructure conditions at village level was taken from a village head questionnaires which had been carried out in parallel to the household surveys.

4. Results and discussion

The prevalence of poverty in the three provinces included in our sample is shown by means of a cumulative distribution of per capita consumption subject to a poverty line of $1.25 (Figure 1a). We pooled data from 2011 and 2013 for the districts in Thailand and Vietnam respectively and data from 2013 and 2014 for Laos. The consumption ranking is shown in figure 1a whereby there is an almost perfect stochastic dominance among the three provinces with poverty highest in Savannakhet and lowest in Ubon Ratchathani.

The differences in consumption among rural and peri-urban areas within the provinces of Thua Thien Hue and Savannakhet are shown in Figure 1b. We find big gaps between peri-urban and rural areas in both Thua Thien Hue and Savannakhet. Interestingly, even the rural region in Thua Thien Hue shows a higher level of consumption than the respective peri-urban area in Savannakhet province. From the middle part of the distribution in Thua Thien Hue there is a convergence tendency between the two peri-urban and rural areas. This implies that the share of very rich households in the peri-urban area is not significantly different from the shares in the rural areas in this province in Vietnam. This difference is, however, not found in Savannakhet in Laos. Hence inequality in consumption is lower in Thua Thien Hue than in Savannakhet. Furthermore, it is striking to notice that the peri-urban areas in Thua Thien Hue and Savannakhet almost converge at higher levels of income indicating that at the higher end of the consumption distribution peri-urban areas in Laos and Vietnam are similar.

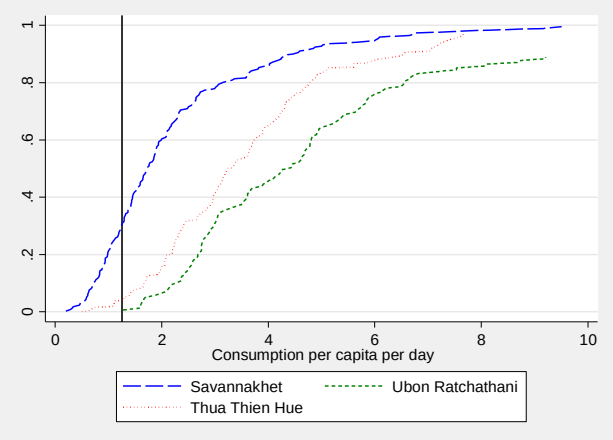


Figure 1a: Province-wise

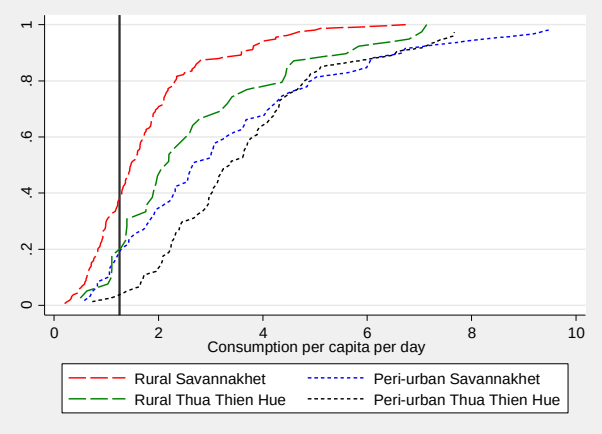


Figure 1b: Area-wise in Savannakhet (Laos) and Thua Thien Hue (Vietnam)

Figure 1: Cumulative distribution of consumption per capita per day
Source: Own calculations based on household survey 2011, 2013, 2014

The major issue of our study concerns the nutritional outcomes of children less than five years in the three provinces in Thailand, Lao PDR and Vietnam (Table 1). Comparing the nutritional outcomes among three provinces in Table 1, the malnutrition rates (WFA and HFA), as expected, are found to be the lowest in Ubon Ratchathani. Specifically, with 10% underweight, this province can be regarded to have low underweight prevalence according to the WHO classification (WHO, 2010) while, with values larger than 20 per cent, Savannakhet and Thua Thien Hue are classified by WHO as areas with high prevalence of underweight. With regard to stunting, all three provinces from Thailand, Vietnam and Laos are characterised by very high prevalence rates as per WHO[5].

[5] Generally, differences between the peri-urban areas across the three countries are higher than differences with reference to wasting, although there is no significant difference among the three provinces across the three countries, all of them experience serious wasting pervasiveness in children under five in the surveyed year.

Table 1: Child under nutrition by area (%)

Province/Area	Underweight (WFA)	Stunting (HFA)
Thailand (Ubon Ratchathani: Peri-urban)	9.83[a,b]	42.11[a,b]
Laos (Savannakhet)		
Peri-urban	19.85[d]	56.62
Rural	23.66[d]	60.21
Vietnam (Thua Thien Hue)		
Peri-urban	27.38[e]	58.02
Rural	41.02[e]	58.97

Notes: The comparison is made by Pearson's chi-squared test, [a]$p<0.01$ for differences between Ubon Ratchathani and Savannakhet; [b]$p<0.01$ for differences between Ubon Ratchathani and Thua Thien Hue; [c]$p<0.05$ for differences between Savannakhet and Thua Thien Hue; [d]$p<0.1$for differences between peri-urban and rural in Savannakhet; [e]$p<0.1$for differences between peri-urban and rural in Thua Thien Hue

Source: Own calculations based on household survey 2011, 2013, 2014

We examine the peri-urban and rural gap by investigating the anthropometric indicators in these two areas separately. The area-wise comparison shows that nutritional statuses of children in peri-urban areas are better than that in the rural area in underweight and stunting indicators. With reference to stunting, no significant gap is observed. These findings are further depicted in the distribution of the z-scores for WFA and HFA with the cut-off of -2SD as shown in Figure 2a and 2b. Although the gaps in WFA Z-scores between peri-urban and rural areas both in Savannakhet and Thua Thien Hue are larger than those for HFA, WFA gaps are smaller than the gaps found in Figure 1b. This suggests that the big gaps in consumption do not translate into big gaps in nutritional outcomes of children across the three areas in these countries in Southeast Asia.

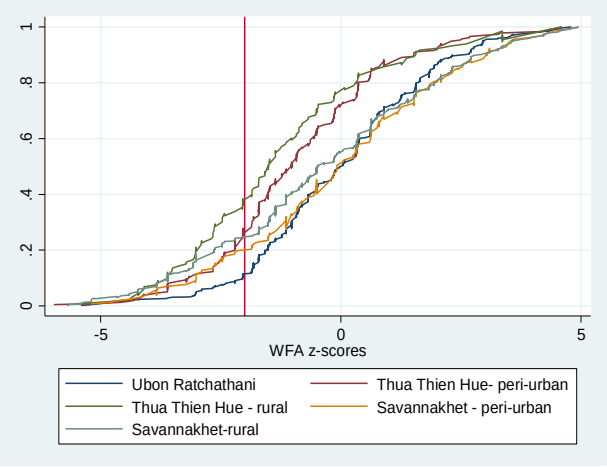


Figure 2a: Weight-for-age Z-scores

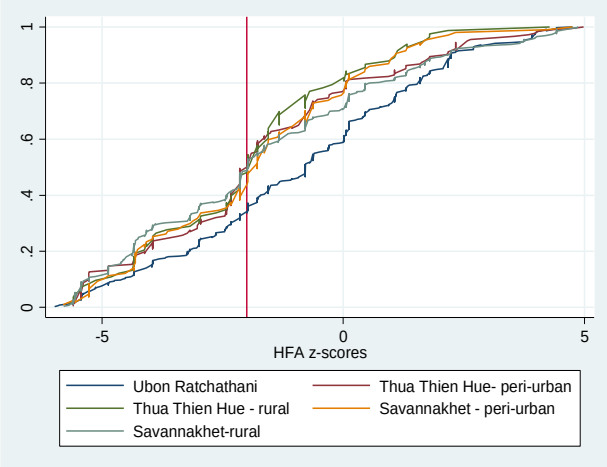
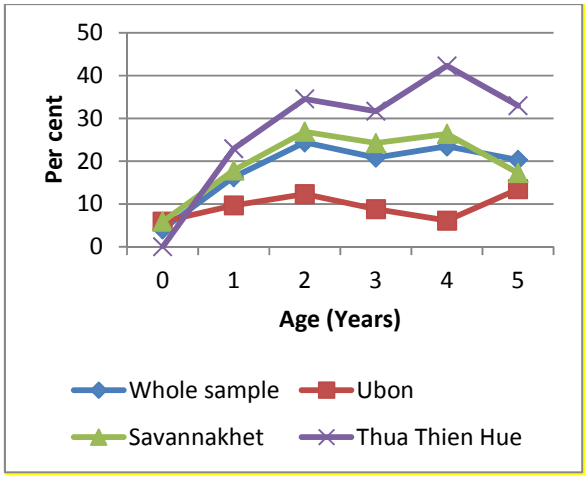


Figure 2b: Height-for-age Z-scores

Figure 2: Cumulative distribution of child anthropometric Z-scores
Source: Own calculations based on household survey 2011, 2013, 2014

We also investigate child nutrition by age at the province level. The results for the underweight in Figure 3a demonstrate a similarity among all three provinces respectively in Thailand, Vietnam and Laos where children below one year are the least likely to be underweight. This could be because they are largely dependent on breast feeding and mother´s nutritional inputs. We do not find much variation in Ubon Ratchathani (Thailand) in the incidence of child underweight among different ages. Underweight rate fluctuates from around 6 per cent for the age less than one until more than 13 per cent for the age of five. In contrast, we find that Savannakhet (Lao PDR) and Thua Thien Hue (Vietnam) show a considerable increasing trend of underweight children from birth to the age of two. Afterwards, the weight-for-age Z-scores improve slightly until children reach the age five. In Thua Thien Hue we find, however, an increase of underweight prevalence again for the age of four. The distribution for the whole sample shows a similar trend to Savannakhet.



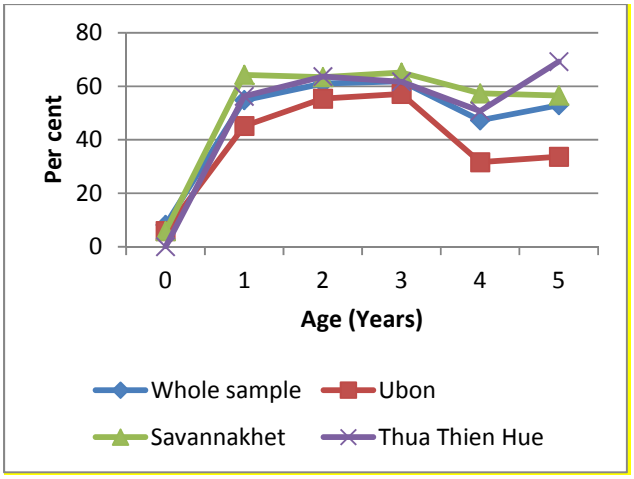


Figure 3a: Child underweight **Figure 3b: Child stunting**

Figure 3: Child undernutrition by age
Source: Own calculations based on household survey 2011, 2013, 2014

Regarding stunting, Figure 3b shows similar shapes for all three provinces across the ages except for the peak at age five for Thua Thien Hue province. For the children from one to three years, the stunting incidence rises dramatically. For example, in Ubon Ratchathani the stunting rate was about 45 percent for age one and peaked with approximately 57 percent at age three. In Savannakhet, the stunting rates are even higher, around 64 per cent. The prevalence in Thua Thien Hue ranges from around 56 per cent to more than 63 per cent for the age interval from one to three. By the age of four and five, the stunting rates decline in all three provinces except for the case of five years in the Vietnamese province of Thua Thien Hue.

We further investigate the nutritional outcomes of children by classifying them into moderate and severe malnourishment based on the threshold of –2 SD and -3 SD below the median of the WHO child growth standards (Table 2). The peri-urban and rural differences across the three countries are compared by means of Pearson's chi-squared tests. It is striking to note that

regardless of child malnutrition indicators – underweight or stunting, and areas- peri-urban or rural; the severe undernutrition rates are much higher than the moderate undernutrition rates (except the underweight in the peri-urban). The gap is extremely large in stunting, especially in the rural area. Table 2 also shows that there is no statistically significant difference across peri-urban and rural areas in terms of moderate undernutrition across the three provinces in Thailand, Vietnam and Laos.

Table 2: Child undernutrition severity by area (%)

Indicator	**Moderate**			**Severe**		
	Rural	Peri-urban	Difference	Rural	Peri-urban	Difference
Stunting (HFA)	9.94	11.74	-1.80	49.91	37.25	12.66***
	(29.95)	(32.21)		(50.04)	(48.37)	
Underweight (WFA)	9.04	9.60	-0.56	17.72	6.82	10.90***
	(28.70)	(29.47)		(38.22)	(25.22)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ of Pearson's chi-squared test, standard deviation in parentheses
Source: Own calculations based on household survey 2011, 2013, 2014

The relationship between undernutrition and wealth status of households are illustrated in Table 3. The wealth status is expressed by household aggregate consumption. We divided households into five quintiles of consumption by province. As expected, children from wealthier households are less likely to be either underweight or stunted. This trend is consistent in Ubon Ratchathani and Thua Thien Hue. Also in Thua Thien Hue, children living in the poorest consumption quintile are more than twice as likely to be underweight and one point five times more stunted compared to children residing in the richest quintile.

Table 3: Child undernutrition by consumption quintile (%)

Province	Consumption quintile				
	1st	2nd	3rd	4th	5th
Ubon Ratchathani					
Underweight (WFA)	11.24	10.47	8.99	9.30	9.20
Stunting (HFA)	52.81	41.86	38.20	47.67	29.89
Savannakhet					
Underweight (WFA)	30.23	20.54	19.82	22.02	17.11
Stunting (HFA)	63.57	66.07	49.55	57.80	58.56
Thua Thien Hue					
Underweight (WFA)	40.38	33.33	33.90	24.07	21.43
Stunting (HFA)	64.42	66.67	59.32	51.85	42.86

Source: Own calculations based on household survey 2011, 2013, 2014

In the next step we investigate the differences in the socioeconomic characteristics of the households between peri-urban and rural areas. We will look at the income and consumption of household, child characteristics, mother characteristics, household features and village characteristics. The comparisons are made for the pooled data of three provinces across the three countries. If the characteristics are continuous and normally distributed, we use a *t* test to compare the means of those characteristics across peri-urban and rural areas. If the characteristics are continuous and not normally distributed, a Wilcoxon rank-sum test is used to compare the sums of the ranks for observations from peri-urban and rural groups. In the case of dichotomous variable, a Pearson's chi-squared test is employed to compare the proportions of that variable between two groups. The test results with the significance level depicted by the number of asterisk are reported in Table 4.

The results show substantial differentials across peri-urban and rural households. For example, peri-urban household's income is generated largely from small scale business but less from

agricultural production as well as hunting, collecting activities whereas the rural household's income is other way around. The total consumption per capita including food and non-food expenses (for example health care, education, communication) of peri-urban households is remarkably higher than that of rural household.

Table 4 also reveals that children residing in peri-urban areas are less likely to get sick than those living in the rural regions. Regarding mother characteristics, the difference is particularly remarkable in the education level, where mother of a peri-urban child has more than six school years compared to almost three years in the rural. The nutritional outcomes in terms of the height of peri-uban mother also seem to be better than rural mother. Furthermore, women in peri-urban areas tend to migrate more than their rural counterparts.

Turning to other features of the household, we find that the peri-urban women seem to have more intra-household decision-making power than the rural women. Specifically, in peri-urban areas around 23% of households are headed by women while only 9% of households in the rural areas have a female household head. Rural households tend to have more household members than peri-urban houses. On average, rural households have nearly one more member compared to their peri-urban counterparts. Furthermore the dependency ratio is higher than that of peri-urban households.

Table 4: Comparison between peri-urban and rural household characteristics

	Rural	Peri-urban	Difference
Income and consumption			
Share of agricultural income (%)	40.43	30.00	10.43 ***
	(35.19)	(32.37)	
Share of natural resource income (%)	27.51	9.63	17.88***
	(32.98)	(25.35)	
Consumption per capita per month (PPP$)	65.40	127.62	-62.22***
	(45.94)	(102.30)	
Food consumption per capita per month (PPP$)	42.22	65.67	-20.45***
	(28.68)	(41.28)	
Household engaged in small business (%)	13.78	41.22	-27.44***
	(34.51)	(49.26)	
Child			
Child is sick (%)	10.92	7.60	3.32*
	(31.23)	(26.52)	
Mother			
Age of mother (Years)	30.43	32.73	-2.3***
	(6.80)	(6.90)	
Height of mother (cm)	151.71	156.34	-4.63***
	(6.20)	(6.15)	
Education of mother (School years)	2.92	6.65	-3.73***
	(3.90)	(4.66)	
Mother migrated (%)	6.52	18.71	-12.19***
	(24.72)	(39.04)	
Household			
Household head is female (%)	9.02	23.25	-14.23***
	(28.69)	(42.27)	
Household size	6.42	5.57	0.85***
	(2.43)	(1.99)	
Dependency ratio (%)	118.59	89.15	29.44***
	(75.81)	(73.70)	
Migration of other members (Days)	139.72	282.18	-142.46***
	(247.95)	(284.46)	
Flush toilet (%)	5.46	22.95	-17.49***
	(22.75)	(42.08)	
Tap water (%)	25.18	54.82	-29.64***
	(43.45)	(49.80)	
Value of assets per capita (PPP$)	516.83	1,666.92	-1150.09***
	(741.97)	(2,982.00)	
Land per capita (ha)	0.10	0.36	-0.26***
	(0.30)	(0.47)	
Village			
Time to reach the next hospital (Minutes)	95.75	26.07	69.68**
	(153.95)	(13.90)	
Village with sanitation (%)	0.00	9.0	-9.06***
	(0.00)	(28.73)	
Village with public water (%)	31.12	77.19	-46.07
	(46.35)	(41.99)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$standard deviation in parentheses
Source: Own calculations based on household survey 2011, 2013, 2014

The peri-urban and rural differences are also found in the domestic sanitation facility and water supply. As expected, the proportion of households having a flush toilet is much higher in the peri-urban (nearly 23%) than in the rural areas (around 5%). Similarly, more than half of peri-urban households have access to tap water while only one-fourth of rural households do. The value of assets per capita and land endowment suggest that peri-urban households are much wealthier and possess more land than rural households. With reference to community attributes, rural residents are also at a disadvantage compared to peri-urban residents. For example, rural dwellers live much further from the hospital than the peri-urban dweller.

We investigate the determinants for nutritional outcomes of children under age five and household food expenses per capita using OLS and district level fixed effects. The estimations are made on pooled data of rural children versus peri-urban children from the three provinces across the three countries. We do not apply the panel data estimate since the estimate on the same children over years is quite problematic (Glewwe et al., 2004). The reason is that stunting and underweight prevalence as shown in Figure 3a and 3b develop substantially in the first two years of life of children but afterwards change. Hence, the impact of household consumption which is classified in four quintiles on nutritional outcomes would be different for the children who passed the 2 year threshold in the second survey (2013 for Ubon Ratchathani in Thailand and Thua Thien Hue in Vietnam while 2014 for Savannakhet in Laos).

We estimate the determinants for weight-for-age Z-scores and height-for-age Z-scores of children separately but follow the same approach. Table 5a and 5b respectively illustrate the estimation results for child HFA and WFA Z-scores and household food consumption per capita for rural versus peri-urban areas. The results of OLS and the district level fixed effects are quite

consistent although there are small differences in the magnitude of the coefficients and standard errors. We find that although all the first three consumption quintiles in both rural and peri-urban areas spend significantly less on food expenses compared to the highest quintile, the rural children are significantly more stunted and underweight than peri-urban kids irrespective of household consumption levels. We also find that the effect of monetary poverty on child nutritional outcomes is somewhat clearly found in the rural households than in their peri-urban counterparts.

In both rural and peri-urban regressions, the coefficients of age and age squared show that as children grow older it is possible for them to improve their weight with adequate nutrition. This result is consistent with the findings of the study of Glewwe et al. (2004) in Vietnam and Kabubo-Mariara et al. (2006) in Kenya. The health condition of the child significantly influences his or her nutritional status. Specifically, on average a sick child has HFA Z-score around 1.6 % less than the score of a healthy child. The statistically negative correlation of the sickness in the previous period of the child with the nutritional outcomes is supported by the nutrition framework of UNCEF (2013).

We find a significant correlation between mother's height and her child's nutritional outcomes. This result is in line with previous studies implying that the nutritional status of the child is influenced by mother's nutritional outcomes (Glewwe et al., 2004; Alderman et al., 2005; Kabubo-Mariara et al., 2006; Waibel and Hohfeld, 2016). While some nutrition studies find that girls have lower nutrition outcomes than girls the (e.g., Sahn and Alderman, 1997; Kabubo-Mariara et al., 2006; Belitz et al., 2010), this is not necessarily the case for countries in Southeast Asia. For example, Glewwe et al. (2004) did not find any correlation between child gender and

malnutrition status in Vietnam. We confirm this observation with our model.

Regarding other household characteristics, the migration of household members has a positive effect on the height of children. This is however only found in the peri-urban area. It might be due to the fact that the peri-urban migrants do not go far as the urban areas are nearby and may have better communication with their households than the rural migrants. The positive effect of migration on nutritional outcomes can be explained through its positive effect on per capita calorie intake and household food diversity which is found in the studies of Nguyen and Winters (2011) and Anton (2010).

While the problem of underweight is less pronounced than stunting we find similar results for the explanatory variables. The estimation results for WFA Z-scores in Table 5b are to some extent similar to those for HFA Z-scores as discussed above. Specifically, child's sickness in the past has significantly negative influence on the current WFA Z-scores. Migration of household members also positively affects the nutritional outcomes in terms of WFA Z-scores of peri-urban children. Different from HFA Z-scores, WFA Z-scores of children are not significantly influenced by mother's height. It is quite reasonable since HFA Z-scores is a pure long-term nutritional indicator while WFA Z-scores in indicator reflecting short-term changes.

Table 5a: Rural vs. Peri-urban Regression on child height-for-age Z-scores

Variables	Rural				Peri-urban			
	Height-for-age Z-scores		Per capita food expenditure		Height-for-age Z-scores		Per capita food expenditure	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
First quintile	-0.629*	-0.622***	-1.539***	-1.539***	-0.019	-0.028	-1.245***	-1.239***
	(-1.89)	(-3.87)	(-23.35)	(-25.74)	(-0.11)	(-0.15)	(-28.30)	(-18.68)
Second quintile	-0.319	-0.300*	-0.925***	-0.924***	0.306*	0.300*	-0.746***	-0.739***
	(-1.03)	(-1.81)	(-19.88)	(-24.52)	(1.91)	(1.76)	(-20.35)	(-13.56)
Third quintile	-0.463*	-0.444***	-0.502***	-0.500***	0.210	0.230	-0.456***	-0.452***
	(-1.80)	(-2.73)	(-10.56)	(-29.50)	(1.40)	(1.18)	(-11.57)	(-9.73)
Child Characteristics								
Child age	-1.529***	-1.528***	0.054	0.054	-0.609***	-0.605***	-0.064*	-0.065*
	(-7.03)	(-3.86)	(1.06)	(1.18)	(-3.28)	(-3.21)	(-1.84)	(-1.66)
Child age squared	0.212***	0.212***	-0.008	-0.008	0.066**	0.064**	0.010*	0.010
	(5.51)	(3.09)	(-0.92)	(-1.15)	(2.19)	(2.11)	(1.77)	(1.56)
Child's sickness	-1.632***	-1.637**	-0.083	-0.083***	-0.885***	-0.868**	0.079**	0.089*
	(-5.07)	(-2.37)	(-0.72)	(-2.79)	(-2.82)	(-2.00)	(2.00)	(1.78)
Child girl	-0.112	-0.104	0.039	0.040	0.163	0.208	0.018	0.023
	(-0.64)	(-0.76)	(1.14)	(0.67)	(1.43)	(1.43)	(0.54)	(0.89)
Mother characteristics								
Mother's height	0.018***	0.018	0.000	0.000	0.051**	0.056*	0.006	0.005
	(3.90)	(1.01)	(0.08)	(0.06)	(2.38)	(1.67)	(1.61)	(1.08)
Mother's education	-0.024	-0.021	-0.006	-0.006	-0.007	-0.013	-0.002	-0.001
	(-0.73)	(-1.46)	(-1.06)	(-0.99)	(-0.50)	(-0.67)	(-0.80)	(-0.39)
Household characteristics								
Number of children under five	-0.002	-0.007	-0.012	-0.013	-0.004	-0.004	0.017**	0.012
	(-0.04)	(-0.04)	(-1.47)	(-0.61)	(-0.12)	(-0.07)	(2.16)	(0.98)

Female headship	0.272	0.264	0.081	0.081	0.204*	0.104	0.015	0.020
	(0.70)	(0.56)	(1.12)	(0.67)	(1.66)	(0.50)	(0.51)	(0.46)
Migration duration	-0.025	-0.014	-0.007	-0.006	0.075**	0.085***	0.022***	0.020*
	(-0.29)	(-0.21)	(-0.49)	(-0.61)	(2.29)	(3.09)	(2.82)	(1.67)
Dependency ratio	-0.043	-0.052	0.051*	0.050*	0.029	0.016	-0.035	-0.029
	(-0.35)	(-0.23)	(1.73)	(1.91)	(0.32)	(0.15)	(-1.55)	(-1.31)
Percentage of agricultural income	0.032	0.023	0.052	0.052	-0.345	-0.405	0.209***	0.196***
	(0.10)	(0.10)	(1.04)	(0.75)	(-1.47)	(-1.46)	(4.76)	(3.42)
Flush toilet	0.434	0.458	0.172	0.181*	0.258	0.300	0.036	0.050
	(1.02)	(0.64)	(1.47)	(1.75)	(1.30)	(1.31)	(0.78)	(0.63)
Tap water	-0.180	-0.184	-0.015	-0.015	0.124	0.023	0.053**	0.063
	(-0.63)	(-0.81)	(-0.33)	(-0.32)	(0.87)	(0.12)	(2.24)	(1.29)
Climatic shocks	0.104	0.077	0.018	0.013	-0.217	-0.228	0.061**	0.056
	(0.49)	(0.18)	(0.55)	(0.18)	(-1.48)	(-1.38)	(2.13)	(1.44)
Country dummies								
Thailand dummy	-	-	-	-	-0.177	-	0.013	-
					(-0.88)		(0.34)	
Vietnam dummy	-1.033***	-	0.116**	-	-1.187***	-	0.144***	-
	(-3.02)		(1.99)		(-4.70)		(2.76)	
Constant	2.511***	2.316**	4.116***	4.141***	0.066	-0.335	4.390***	4.462***
	(4.97)	(2.51)	(34.95)	(14.30)	(0.11)	(-0.37)	(45.73)	(34.71)
N	545	545	545	545	782	782	782	782
R- squared	0.171	0.129	0.690	0.686	0.142	0.099	0.615	0.613
P value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, t statistics in OLS regression and z statistics in 2SLS regression in parentheses, [a]only children with a complete vector of explanatory variables are included in the regression

Source: Own calculations based on household survey 2011, 2013, 2014

Table 5b: Rural vs Peri-urban Regression on child weight-for-age Z-scores

Variables	Rural				Peri-urban			
	Weight-for-age Z-scores		Per capita food expenditure		Weight-for-age Z-scores		Per capita food expenditure	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
First quintile	-0.588**	-0.577**	-1.555***	-1.555***	-0.043	-0.070	-1.250***	-1.244***
	(-2.45)	(-2.11)	(-23.01)	(-26.82)	(-0.26)	(-0.43)	(-24.88)	(-18.13)
Second quintile	-0.322	-0.299	-0.926***	-0.926***	0.312**	0.307	-0.746***	-0.739***
	(-1.20)	(-1.32)	(-18.24)	(-23.23)	(1.99)	(1.63)	(-17.97)	(-12.81)
Third quintile	-0.463*	-0.440	-0.508***	-0.505***	0.232*	0.248	-0.454***	-0.451***
	(-1.75)	(-1.52)	(-11.27)	(-28.27)	(1.68)	(1.32)	(-10.13)	(-10.36)
Child characteristics								
Child age	-1.489***	-1.487***	0.048	0.048	-0.625***	-0.614***	-0.063*	-0.064*
	(-6.79)	(-3.59)	(0.92)	(1.14)	(-3.40)	(-3.59)	(-1.68)	(-1.50)
Child age squared	0.205***	0.204***	-0.007	-0.007	0.068**	0.066**	0.010	0.010
	(5.55)	(2.87)	(-0.81)	(-1.06)	(2.31)	(2.31)	(1.64)	(1.44)
Child's sickness	-1.668***	-1.674*	-0.086	-0.085***	-0.829***	-0.828**	0.080	0.090
	(-5.46)	(-1.70)	(-0.97)	(-2.93)	(-2.88)	(-2.04)	(1.62)	(1.22)
Child girl	-0.084	-0.075	0.036	0.037	0.192	0.234*	0.019	0.024
	(-0.50)	(-0.58)	(0.91)	(0.79)	(1.53)	(1.77)	(0.74)	(0.92)
Mother characteristics								
Mother's height	0.000	0.001	-0.003*	-0.003	0.016	0.009	-0.003	-0.003
	(0.03)	(0.02)	(-1.91)	(-0.80)	(1.51)	(0.76)	(-1.13)	(-0.95)
Mother's education	-0.023	-0.020*	-0.006	-0.006	-0.014	-0.020	-0.002	-0.002
	(-0.86)	(-1.80)	(-0.92)	(-1.06)	(-1.08)	(-1.11)	(-0.83)	(-0.49)
Household characteristics								
Number of children under five	-0.013	-0.018	-0.011	-0.012	-0.010	-0.007	0.015**	0.011
	(-0.25)	(-0.12)	(-1.31)	(-0.79)	(-0.25)	(-0.11)	(2.23)	(0.99)
Female headship	0.260	0.250	0.090	0.089	0.153	0.062	0.012	0.019
	(0.87)	(0.45)	(1.23)	(0.78)	(0.86)	(0.32)	(0.34)	(0.41)
Dependency ratio	-0.052	-0.063	0.051**	0.051*	0.029	0.017	-0.035*	-0.029
	(-0.38)	(-0.21)	(2.41)	(1.87)	(0.34)	(0.16)	(-1.84)	(-1.30)

Percentage of agricultural income	-0.005	-0.017	0.057	0.058	-0.311	-0.370	0.211***	0.199**
	(-0.01)	(-0.12)	(1.23)	(0.76)	(-1.13)	(-1.46)	(4.56)	(2.40)
Migration duration	-0.026	-0.014	-0.008	-0.007	0.071**	0.079***	0.021***	0.020*
	(-0.37)	(-0.16)	(-0.65)	(-0.88)	(2.30)	(3.01)	(2.74)	(1.75)
Flush toilet	0.416	0.437	0.183	0.192**	0.257	0.304	0.041	0.055
	(1.19)	(0.63)	(1.40)	(2.55)	(1.56)	(1.18)	(1.16)	(0.76)
Tap water	-0.185	-0.190	-0.013	-0.013	0.146	0.042	0.053	0.063
	(-0.71)	(-0.84)	(-0.23)	(-0.26)	(1.25)	(0.22)	(1.59)	(1.44)
Climatic shocks	0.136	0.106	0.014	0.010	-0.214*	-0.225	0.060**	0.055
	(0.60)	(0.22)	(0.37)	(0.17)	(-1.71)	(-1.18)	(2.01)	(1.42)
Country dummies								
Vietnam dummy	-1.088***	-	0.116*	-	-1.315***	-	0.127***	-
	(-3.26)		(1.84)		(-6.31)		(2.62)	
Thailand dummy	-	-	-	-	-0.224	-	0.021	-
					(-1.03)		(0.49)	
Constant	2.245	1.966	3.048***	3.061***	-1.222	-0.622	3.704***	3.770***
	(1.07)	(0.28)	(11.76)	(4.51)	(-0.69)	(-0.32)	(9.95)	(7.17)
N	545	545	545	545	782	782	782	782
r2	0.165	0.122	0.691	0.687	0.137	0.089	0.615	0.613
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, t statistics in OLS regression and z statistics in 2SLS regression in parentheses, [a]only children with a complete vector of explanatory variables are included in the regression

Source: Own calculations based on household survey 2011, 2013, 2014

In summary, the estimation results for HFA Z-scores and WFA Z-scores of children point out that child nutritional outcomes in Ubon Ratchathani (Thailand), Savannakhet (Lao PDR) and Thua Thien Hue (Vietnam) vary much by age of the child. The major determinants of outcomes both in rural and peri-urban areas include child health status and mother's nutritional status in terms of height although the magnitudes of their impacts are quite different across areas. The results also reveal two differences in the nature of determinants between rural and peri-urban areas. Firstly, aggregate household consumption has a greater effect on the child nutritional status in the rural areas than in the peri-urban area. Second, the migration of household members impacts nutritional status of children in the peri-urban but not in rural areas.

5. Summary and Conclusions

Using a comprehensive household panel data from three provinces in Thailand, Lao PDR and Vietnam we examine the difference in nutrition poverty outcomes between rural and urbanizing areas in these three countries. We believe that our data set is representative for many of the fast growing countries in Southeast Asia. We use data from panel surveys and apply an ordinary least squares as well as a district level fixed effects regression.

The most important finding of this paper is that malnutrition remains a problem in the growing economies of the three countries in both peri-urban and rural areas. Even in the province of Ubon Ratchathani in Thailand which is a rapidly urbanizing region with almost zero poverty and average per capita income (not including the provincial and district capitals) of over 3000 $ PPP per capita, malnutrition remains a problem; although the situation is better than in the two provinces in Vietnam and Lao PDR, Thua Thien Hue and Savannakhet. As expected, we do find that malnutrion in rural areas is worse than in the urbanizing regions. On the other hand, the

rural-urban differences in the province of Hue (VN) are less pronounced than expected. Between the two major nutrition outcome indicators, i.e. underweight and stunting; the latter is the bigger problem. Also undernutrition categorized as “severe” is high in all three provinces.

Another result is that Ubon Ratchathani is quite homogenous both in terms of monetary poverty and undernutrition. On the contrary, Savannakhet and Thua Thien Hue are heterogeneous between the peri-urban and rural areas. The heterogeneity in monetary poverty is larger than in undernutrition. Specifically, the rural areas in these two provinces are doing worse than the peri-urban area in improving the underweight of children. These findings highlight that although Thailand, Vietnam and Laos are at different stages of growth rural children are always more malnourished than their peri-urban counterparts.

A key insight is that irrespective of income levels rural children are more stunted and underweight than their urban counterparts despite both regions spending significantly less on food. Child health primarily drives child nutritional outcomes in both peri-urban and rural areas. Results imply that even though a peri-urban child can be sick it is less likely to be stunted or underweight contrary to rural sick children who are also prone to be malnourished. This implies that apart from nutrition access to medical facilities for children are vital for development. Moreover in peri-urban setting, social and extended family networks play a critical role in childcare; while in the rural areas mother`s nutritional outcomes largely determine child health.

Overall, our findings show that success in reducing monetary poverty does not lead to the same degree of success in reducing nutrition poverty. To improve nutrition, other measures are necessary such as improving child health care facilities and household sanitation. Moreover, awareness needs be created to involve female members in intra household decision making in

favor for child nutrition. Furthermore, the rural and peri-urban nutritional gaps need to be bridged. However, different strategies should be adopted to improve peri-urban and rural child nutrition. Cost-effective childcare services should be established in peri-urban areas and schemes need to be developed to build medical facilities to improve nutritional outcomes of children in rural areas.

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